

PSYCHOLOGY 305

COGNITIVE PROCESSES

No quiz

Review

Attention (p272-301)

1. What is attention
2. When does attention kick in: Early versus late selection?
3. How: Feature Integration Theory (FIT)
4. Spatial neglect

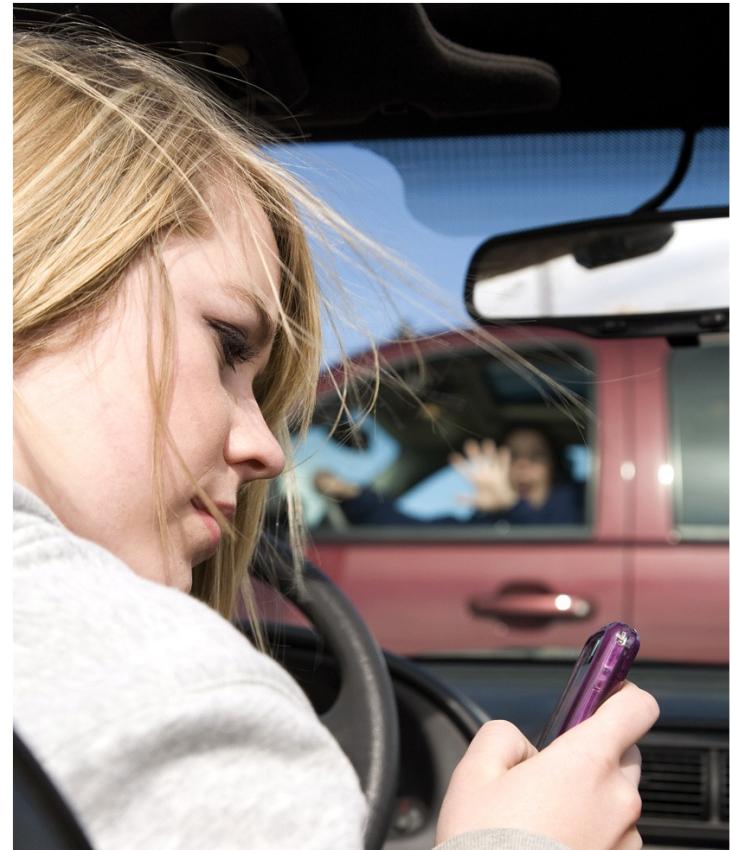
Attention!

**Drive Now
Talk Later**



Driving & Cell Phone

- Redelmeier & Tibshirani
(The New England Journal of Medicine, 1997)
 - “The risk of a collision when using a cellular phone was four times higher.”
 - “... result from a driver’s limitations with regard to **attention** rather than dexterity”

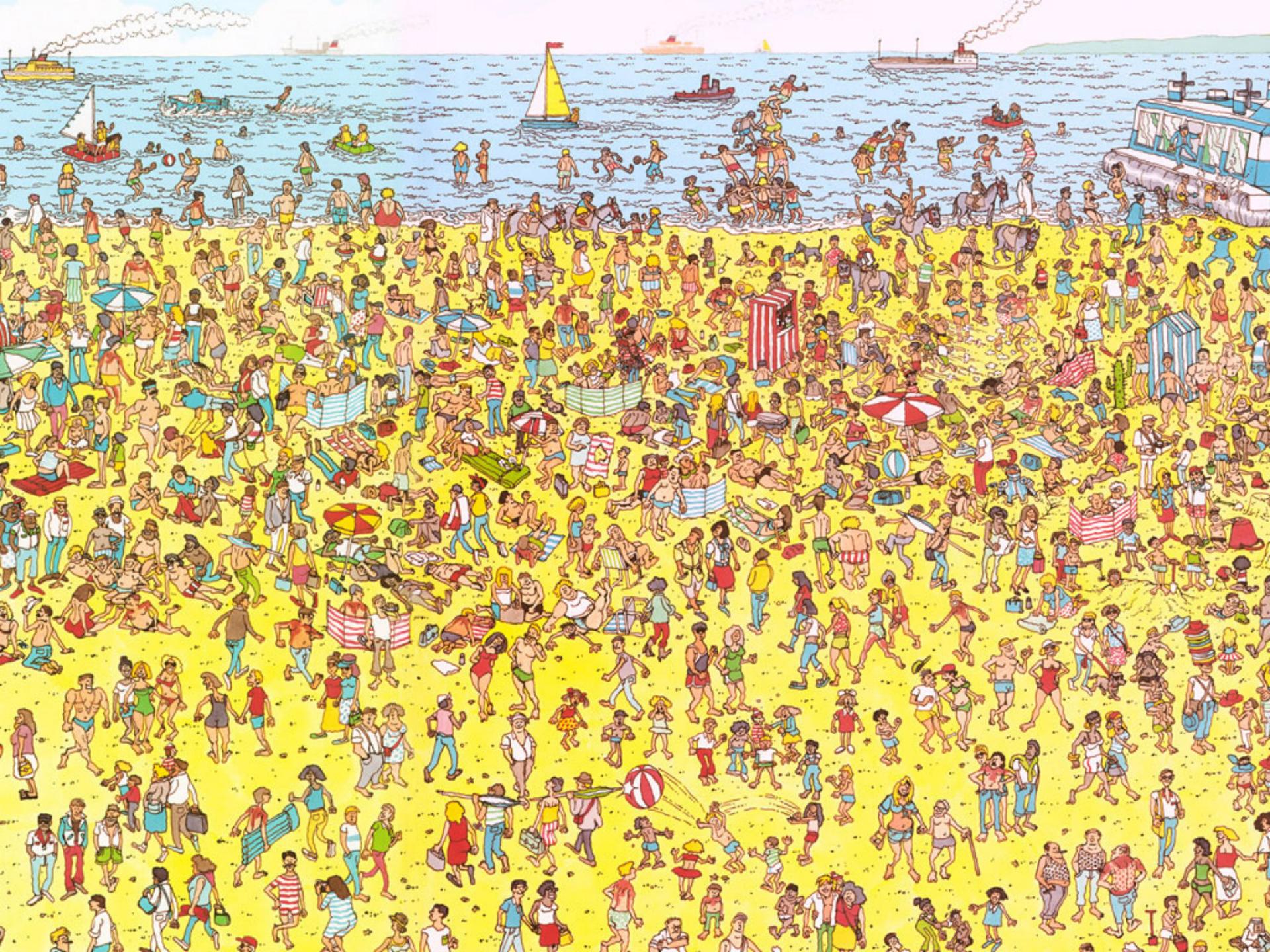


Where is Waldo?

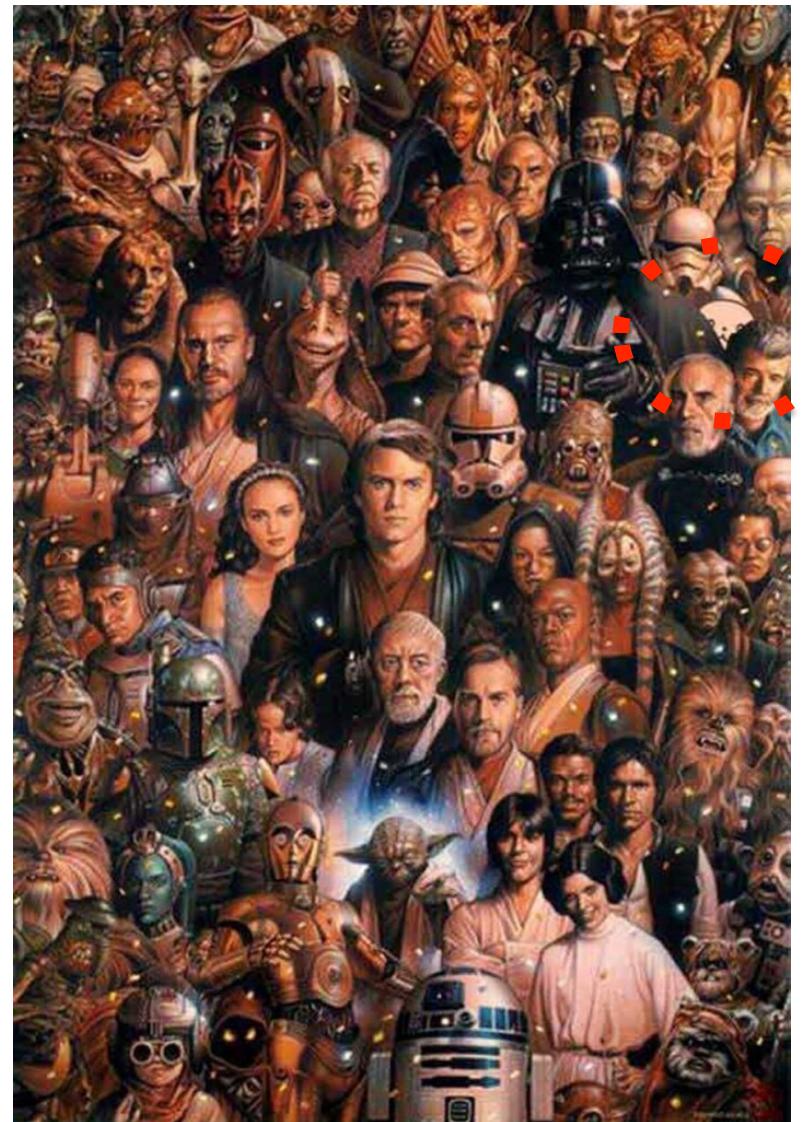
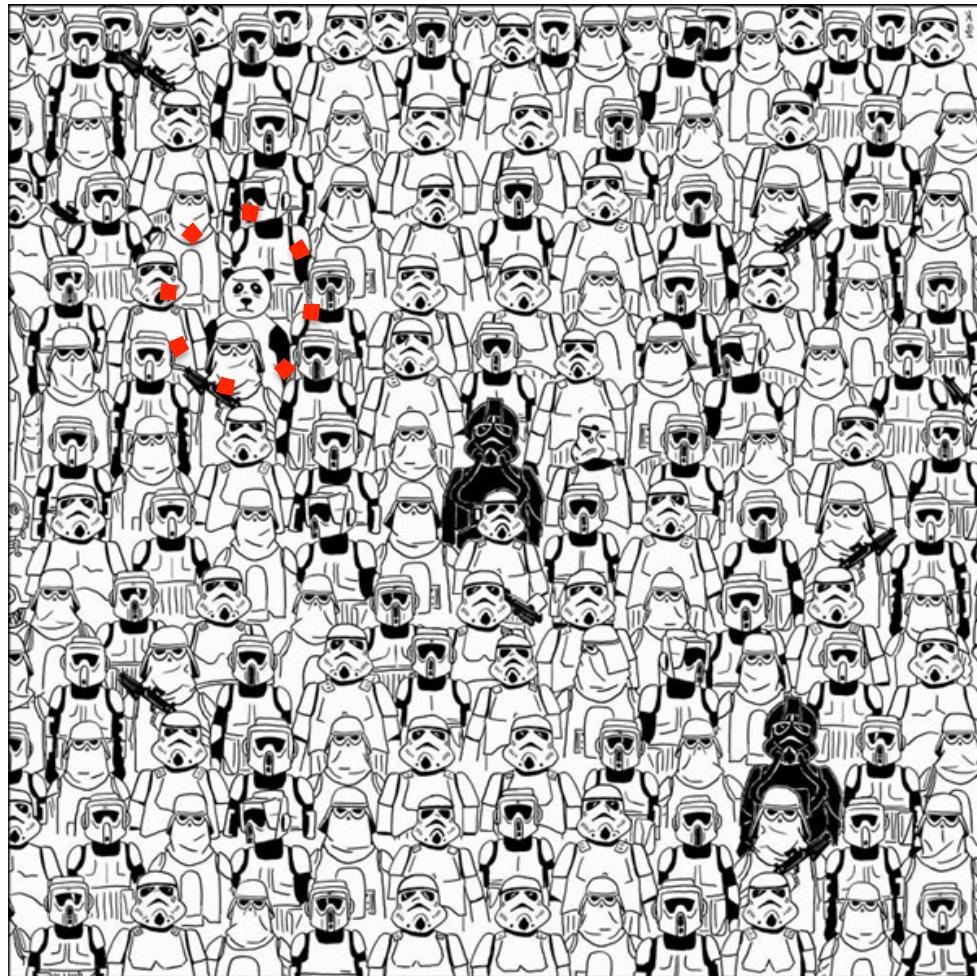


Clap your hands when
you find him





Finding Panda



What is attention?

- *William James* – taking possession of the mind, concentration of consciousness
- *Gottlieb* – improvement in the ability to discriminate detect or memorize attended object
- *Book* – mechanism that enables one to process relevant inputs, thoughts, or actions while ignoring others



- We have a *limited capacity* to process information.
- Therefore there is *competition* between items for processing.
- Attention is the mechanism that selects the most important/ behaviorally relevant information at the cost of others.

What is attention for?

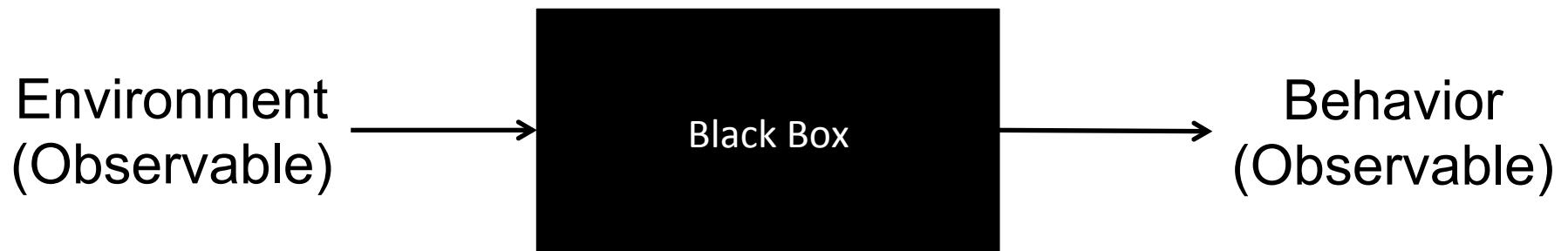
- We have limited capacity to process sensory information.
- Sensory overload



Dave Sullivan

Reflexive attention

- Automatic orienting of attention toward a stimulus



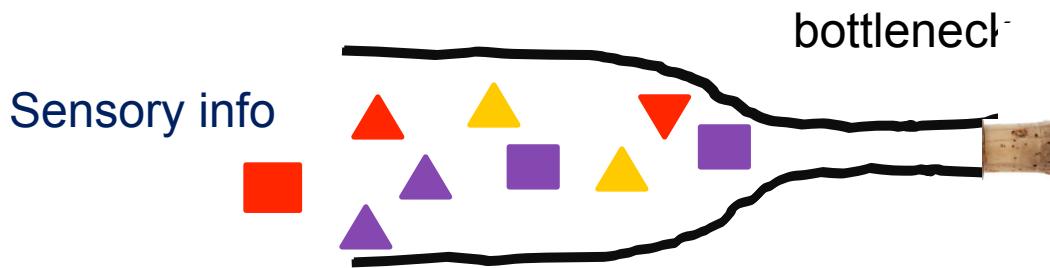
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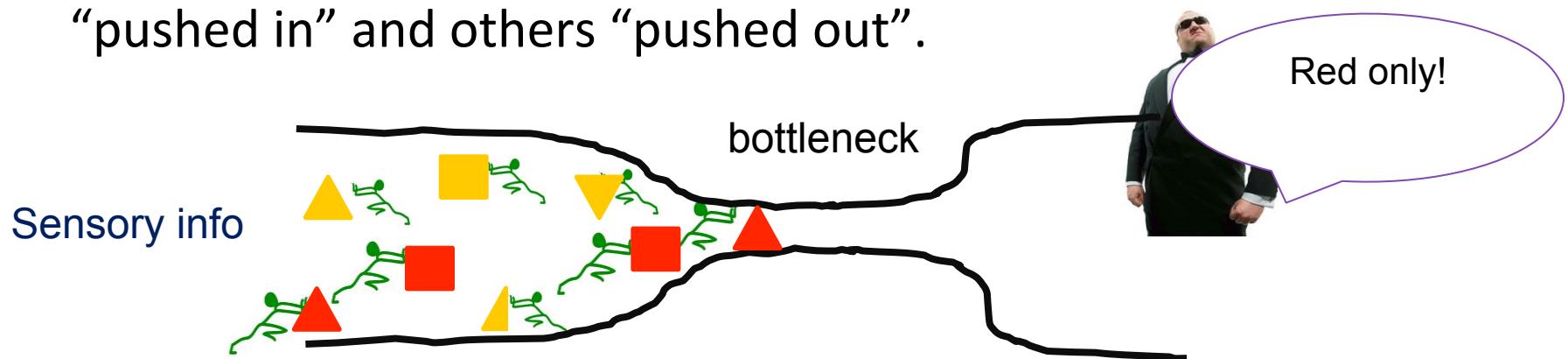
Two mechanisms of selection

- Voluntary attention : select information relevant to current goals and ignore irrelevant information (top-down).
 - Finding Waldo.
- Reflexive attention: re-orienting towards unexpected, but potentially important information.
 - Turning towards sound of sirens.
 - Flashy online ads

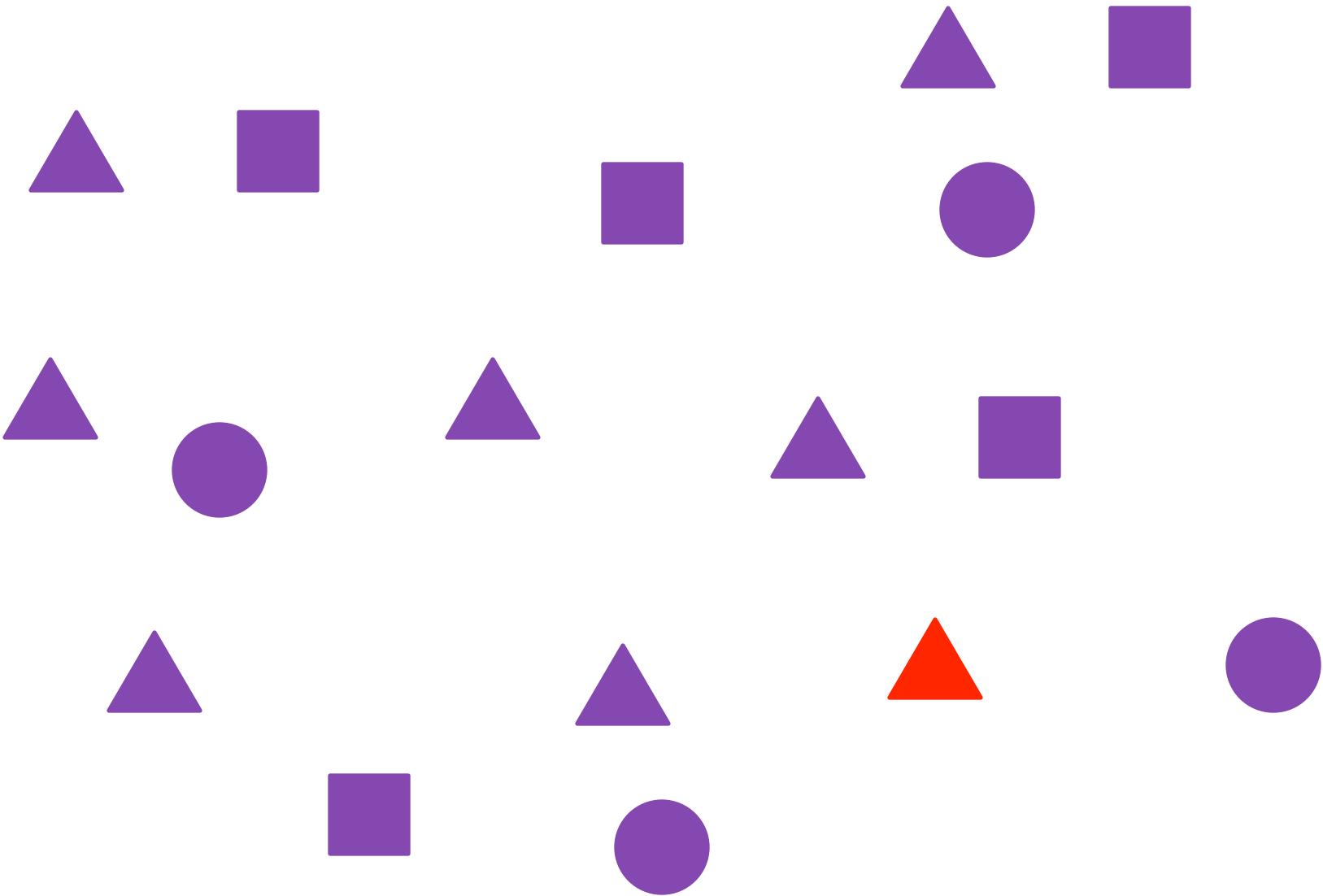
Limitations in processing can be described as a “bottleneck”

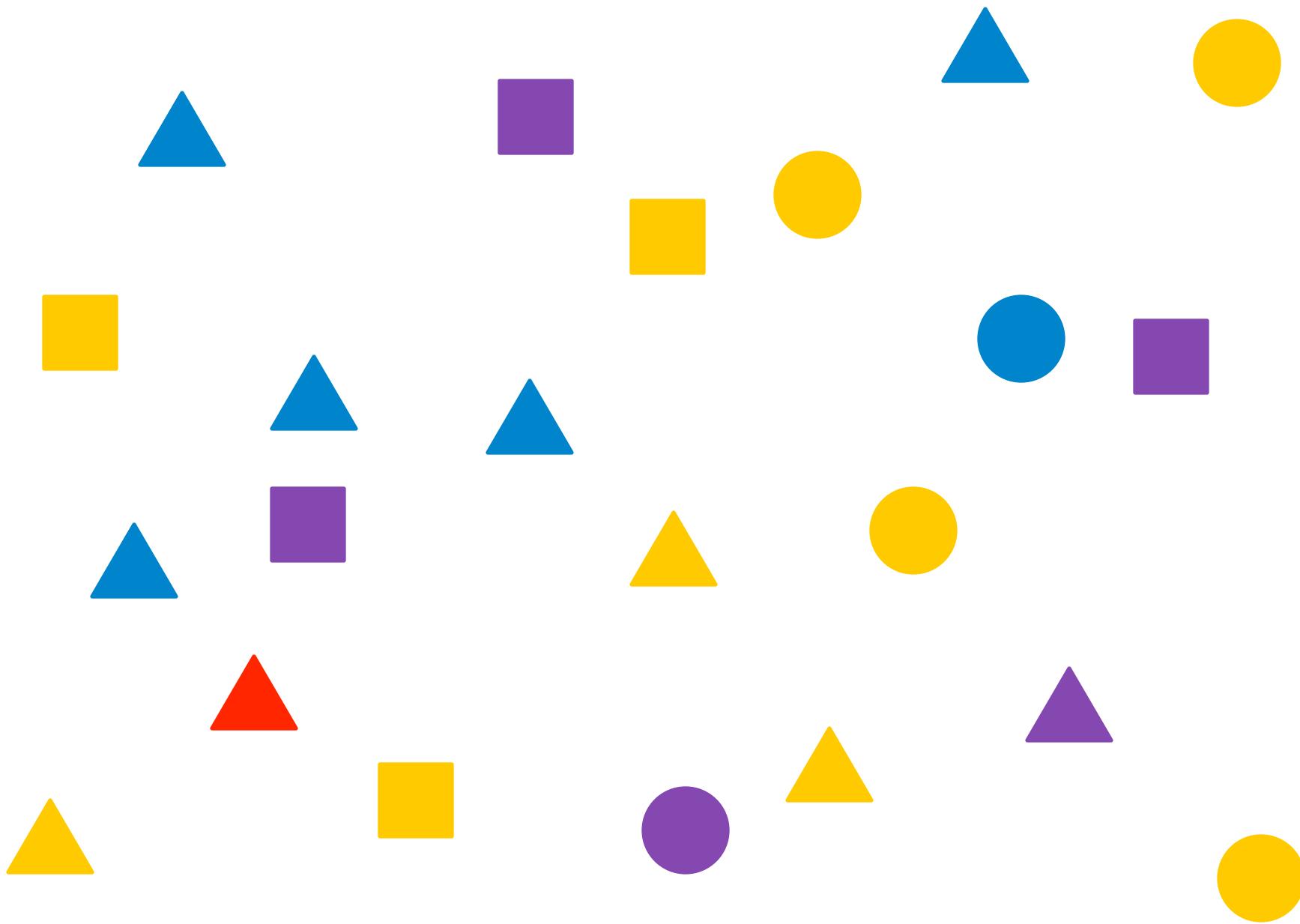


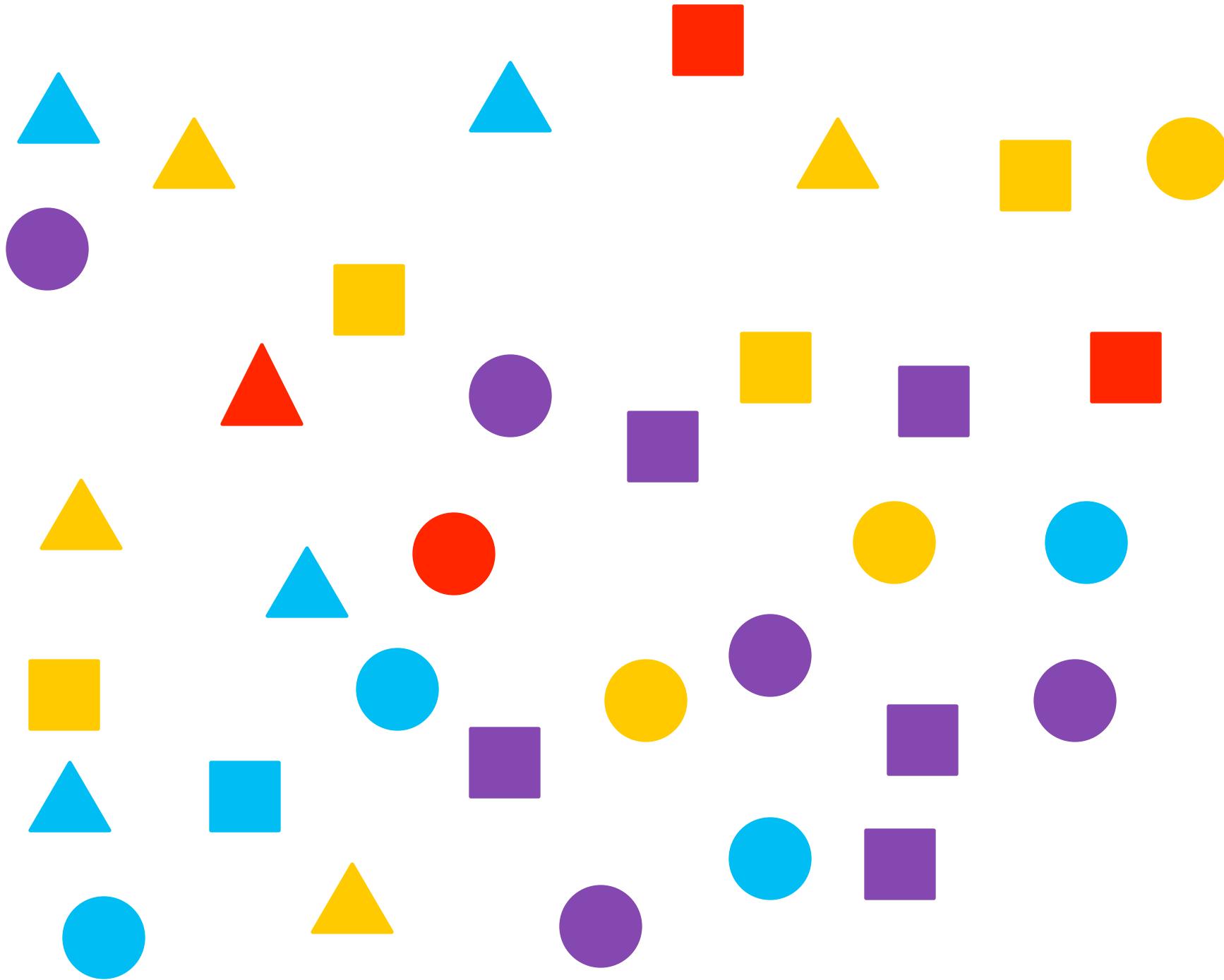
Attention is the process by which some things get “pushed in” and others “pushed out”.

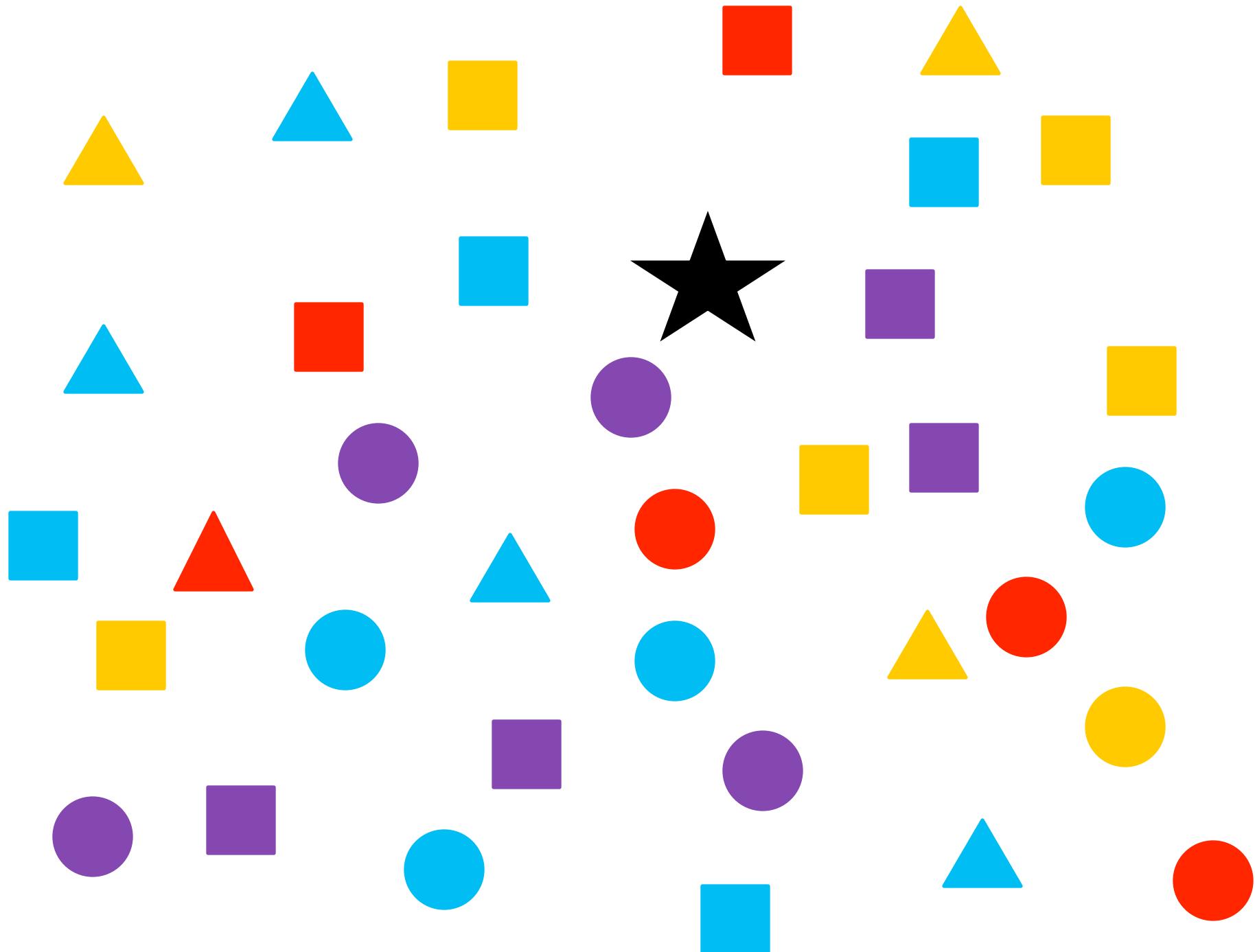


Find the red triangle







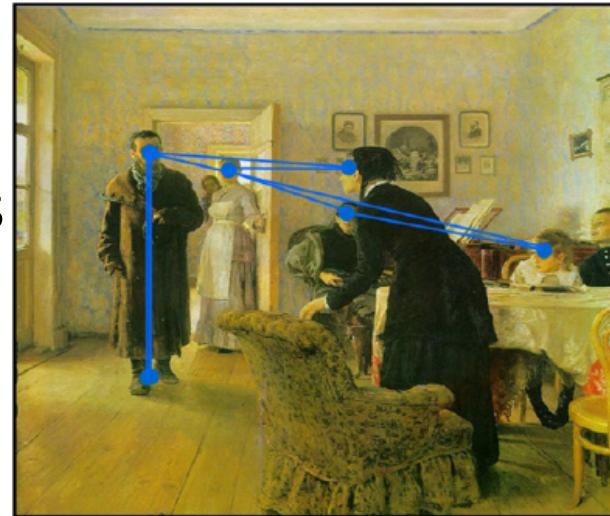


What Grabs Your Attention?

- Where were the yellow circles located?
 - Capacity limits
- Black star?
 - Reflexive attention
- How did you locate the red triangle?
 - Voluntary attention
 - Eye-movements

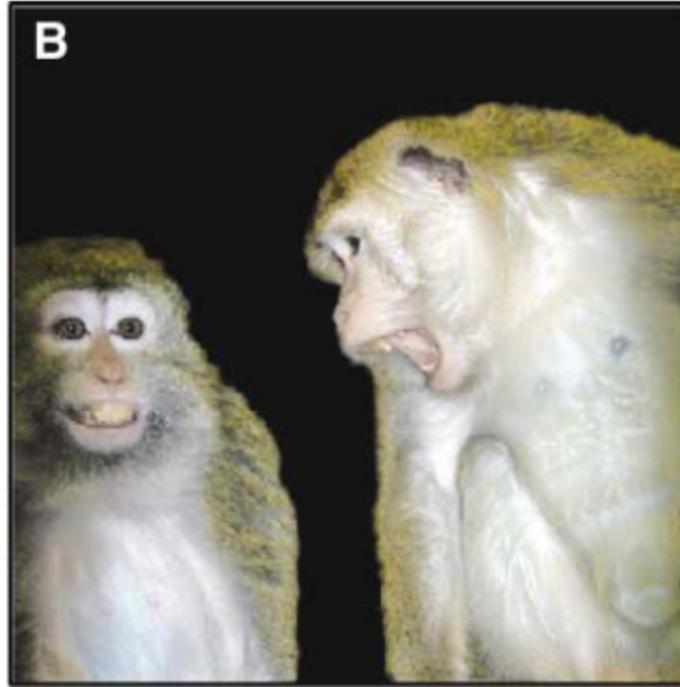
Eye Movements and Visual Attention

- We can see details only at the center of gaze
- We therefore make frequent eye movements to bring information into high resolution fovea and inspect objects of interest
 - Approximately 3 per second during scene viewing
 - This is called “**overt**” attention



But we don't always move our eyes when we shift our attention.

What are you looking at?



Moore et al. 2003

Overt attention is too slow due to the speed of eye movements

But we don't always move our eyes when we shift our attention.

Covert attention – attention to stimulus you are not looking at



Covert selection

X	X	X	X	X
X	X	X	X	X
X	X	X	X	X
X	X	X	X	X
X	X	+	X	X
X	X	X	X	X
X	X	X	X	X
X	X	X	X	X
X	X	X	X	X
X	X	X	X	X

- Helmholtz experiment

Covert selection

N	U	P	M	O
M	L	Y	A	P
B	O	T	R	K
V	K	H	C	H
C	J	+	U	U
X	H	E	S	I
Z	G	W	H	L
A	F	Q	N	B
S	D	Y	I	E

- Helmholtz experiment

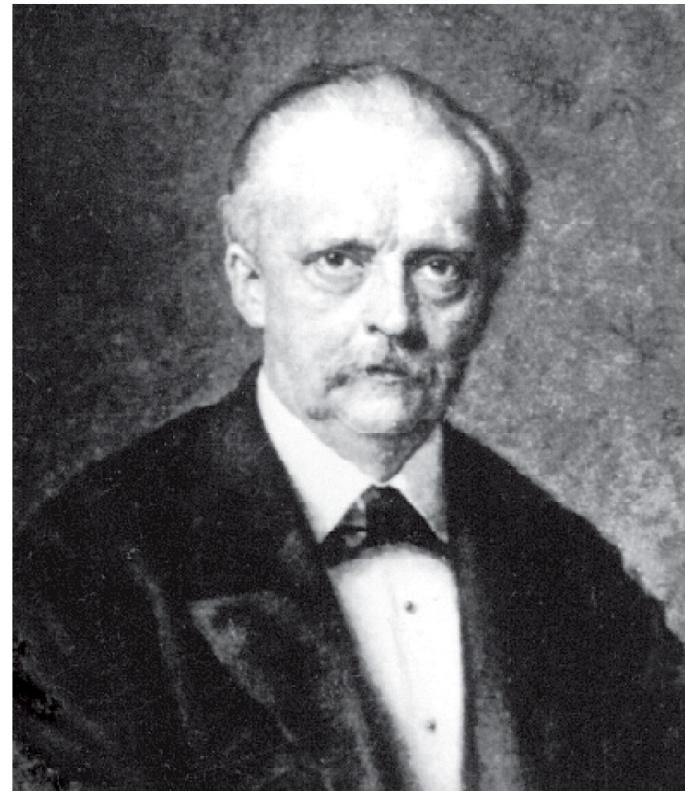
What letters did you see?



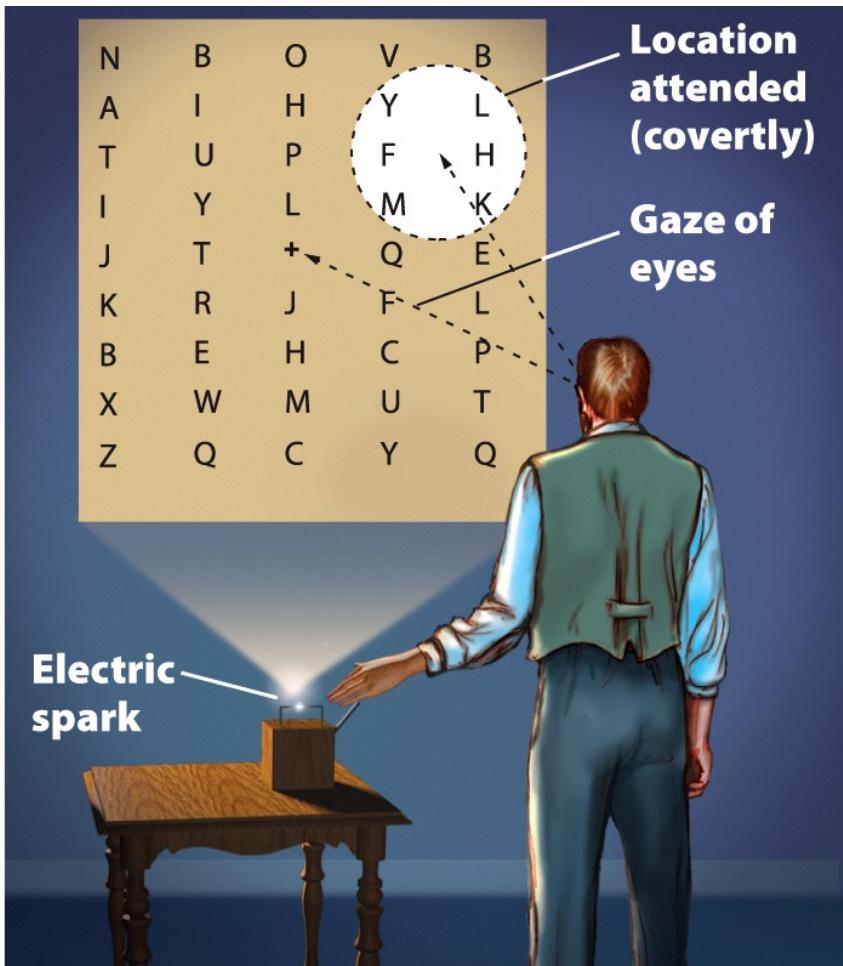
Helmholtz's visual attention experiment

- Covert attention
(without eye movements) is also possible

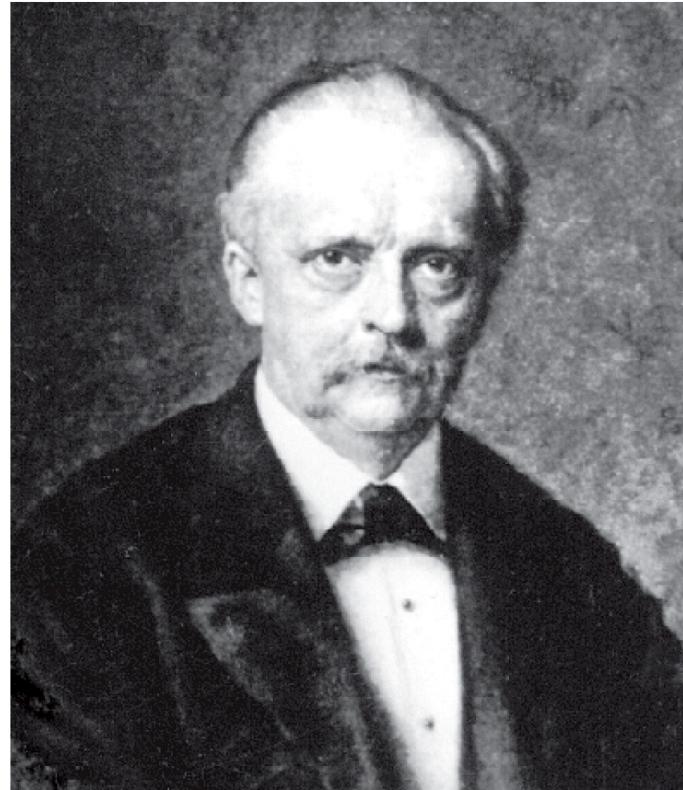
Hermann von Helmholtz (1821–1894)



Helmholtz's visual attention experiment



Hermann von Helmholtz (1821–1894)



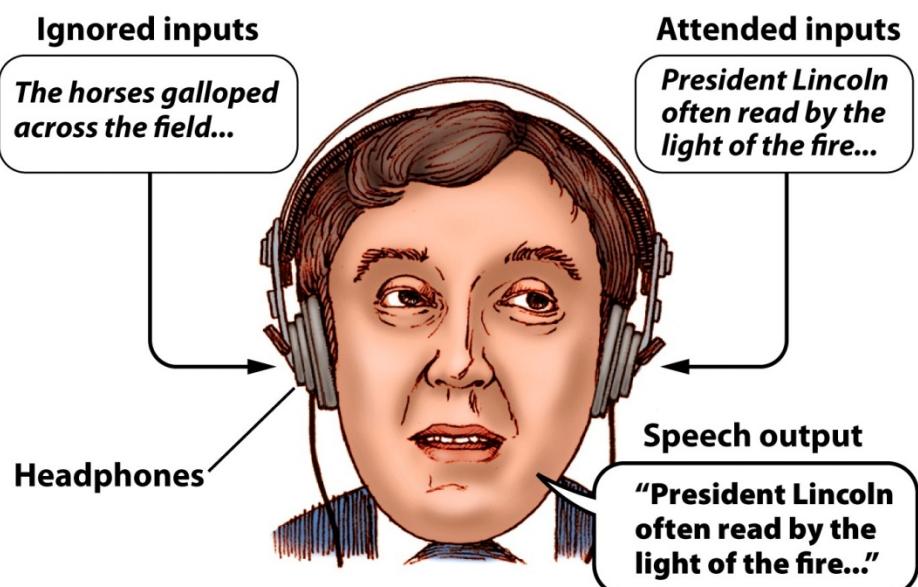
Bettmann/Corbis

could covertly attend to any location on the screen and perceive the letters located within this region but had difficulty perceiving the letters at other locations.

Covert selection

Dichotic listening (Cherry, 1953)

Shadow and repeat information stream in one ear. Ignore the other.



Filtering

- The problem with cocktail parties...



Cocktail party effect



- 3 properties:
 - Ability to select one information stream.
 - Ability to *covertly* attend to another stream.
 - Higher sensitivity to words of interest

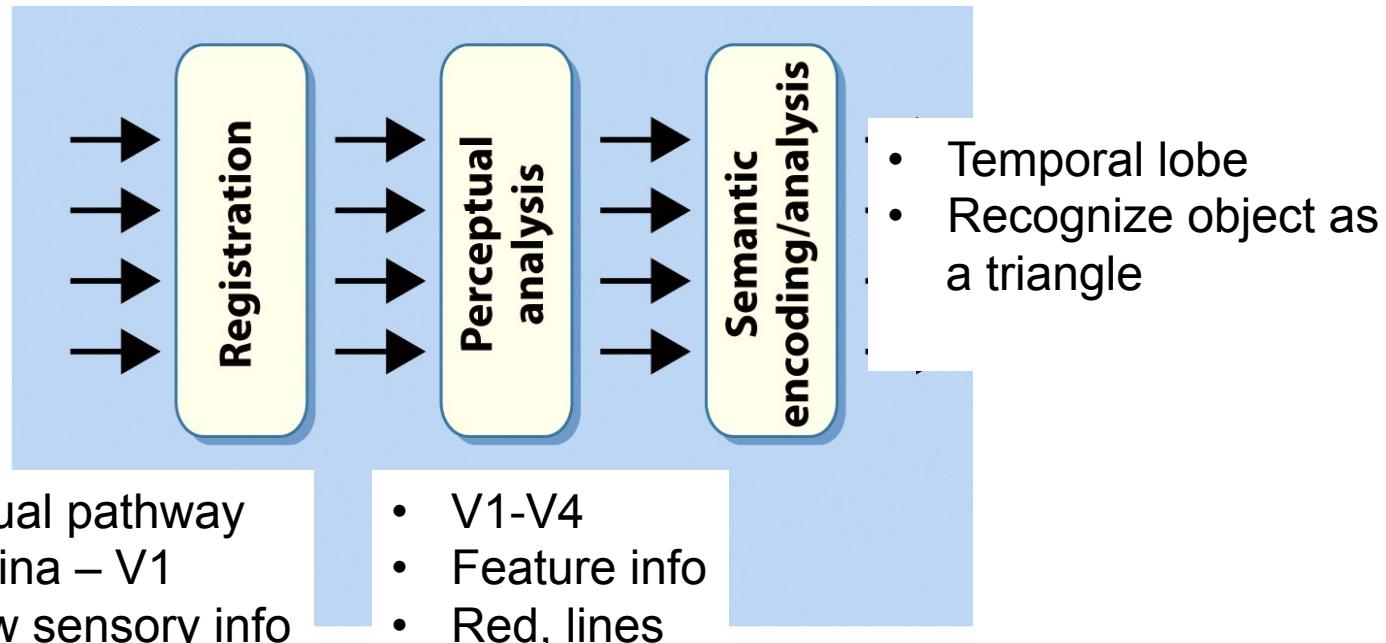
Summary

- Limited capacity
 - “bottleneck” in processing
- Able to selectively attend to goal relevant information
 - Overtly (eye-movements), but also covertly
 - Domain general (e.g., vision, audition)
 - What is the mechanism for selection?



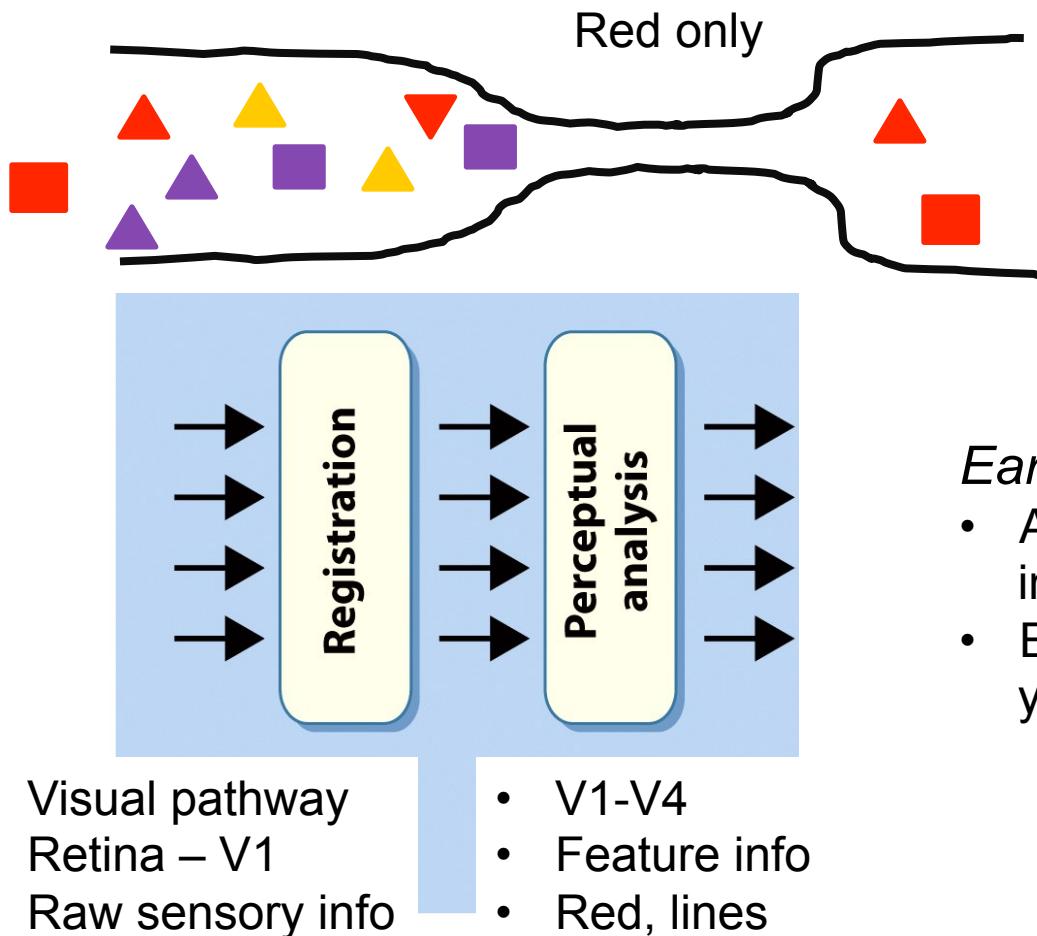
Early vs. late selection

'Find the red triangle'



Semantics: meaning behind what you are perceiving

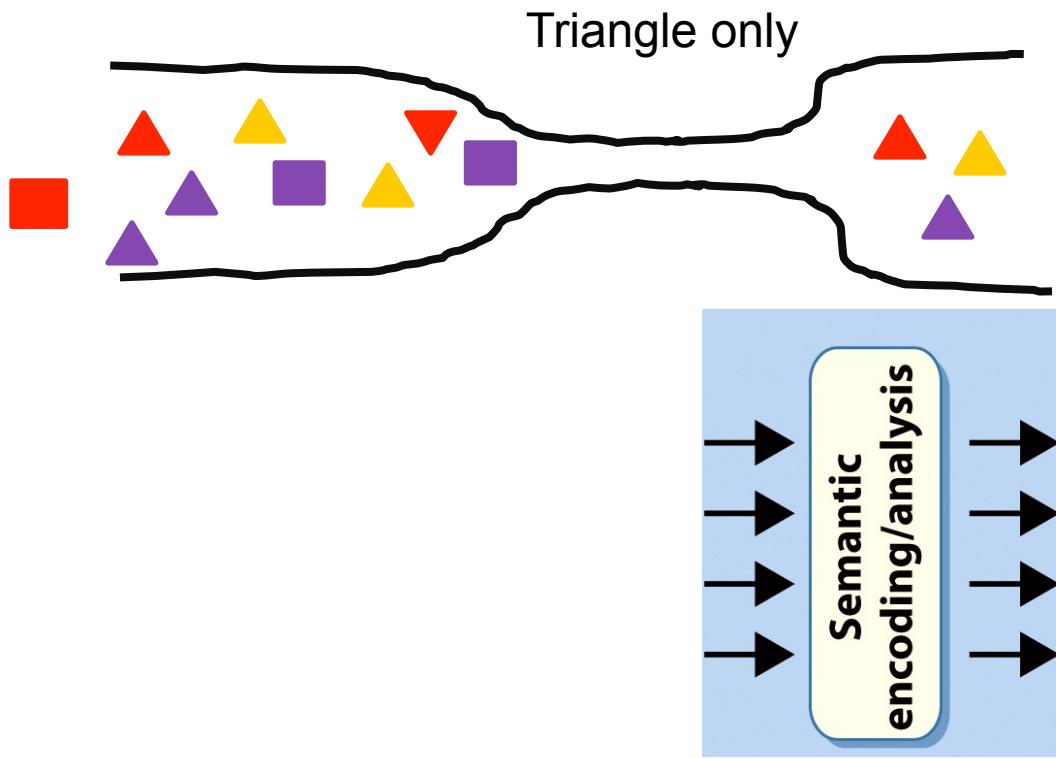
Early: select based on features



Early selection

- Attention selects basic feature information
- Ex: when looking for Waldo, you may attend to red

Late: select based on semantics

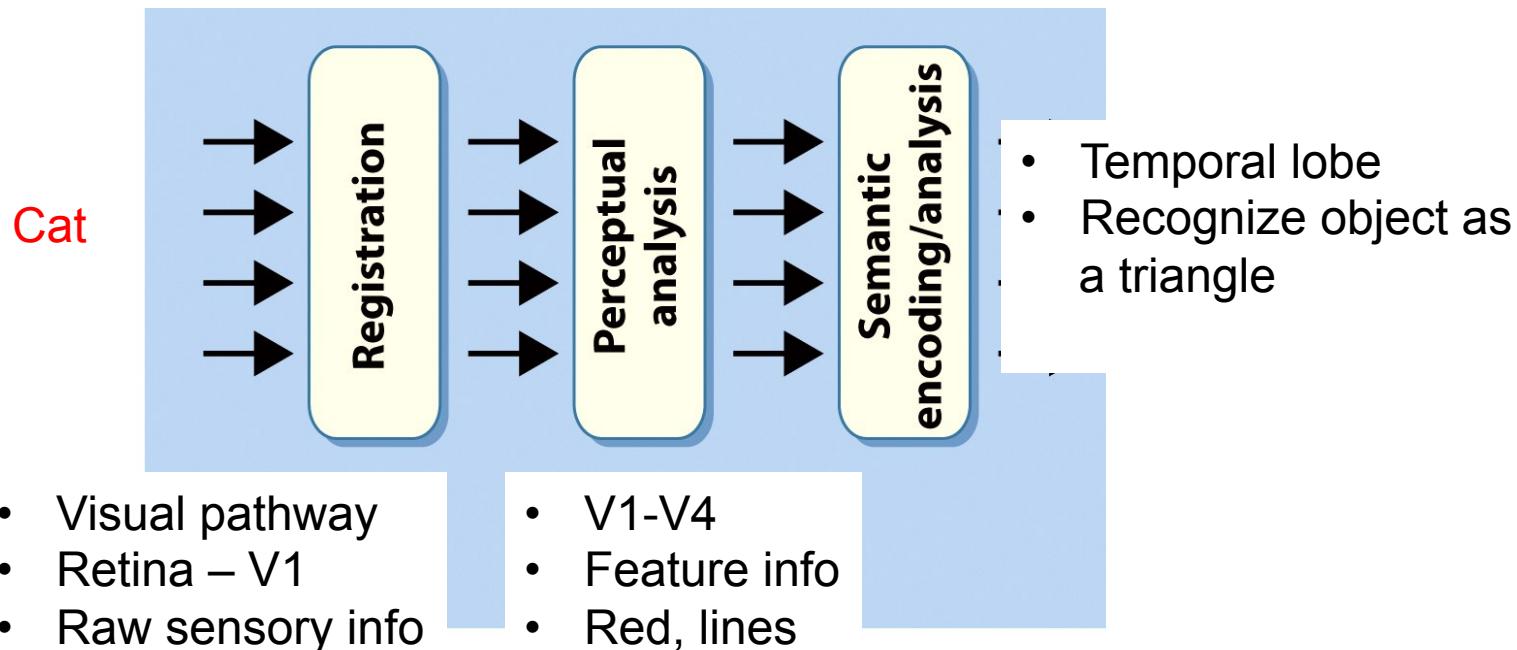


Late selection

- Attention selects semantic information
- Ex: when looking for Waldo, you look for Waldo
 - Recognize him first, then select him

- Temporal lobe
- Recognize object as a triangle

Early vs. late selection



Early: select red and line shapes of the letters

Late: select ‘Cat’ by knowing its meaning, and check if it’s red

How You Tune Out Your Spouse?

- Johnsrude et al (2013)
- We could selectively listen to our spouse's voice and suppress other voices in situations like cocktail parties
- We could also selectively filter out spouse's voice
- But how?
 - Late selection: do we choose to ignore spouse's voice?
 - Early selection: do we turn down the volume in auditory perception?



Early versus late attention selection

- Early – Select *sensory* information to be processed
 - Ignore spouse's voice
- Late – once the information is processed, select which to attend to
 - Still hear spouse's voice, but choose to ignore it

Agenda

- Continue with attention
 - Early versus late
 - Spatial neglect
 - Different forms of attention blindness

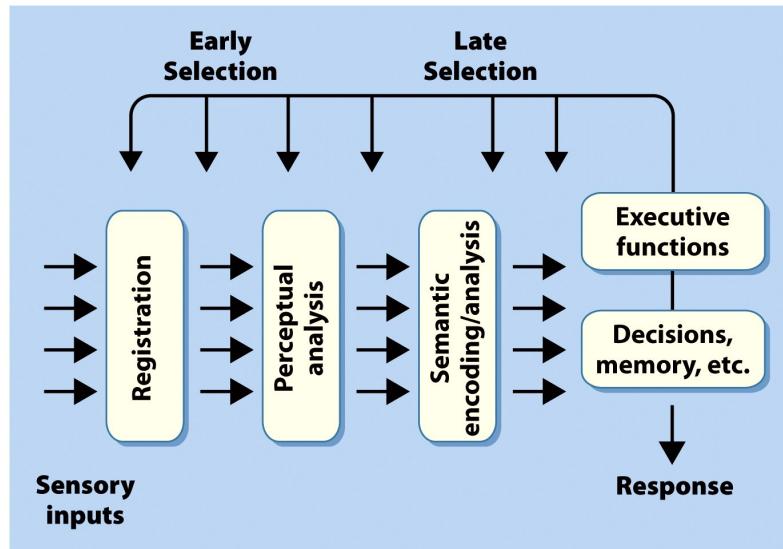
Example: conversation with a friend

Focus on or ignore friend's voice



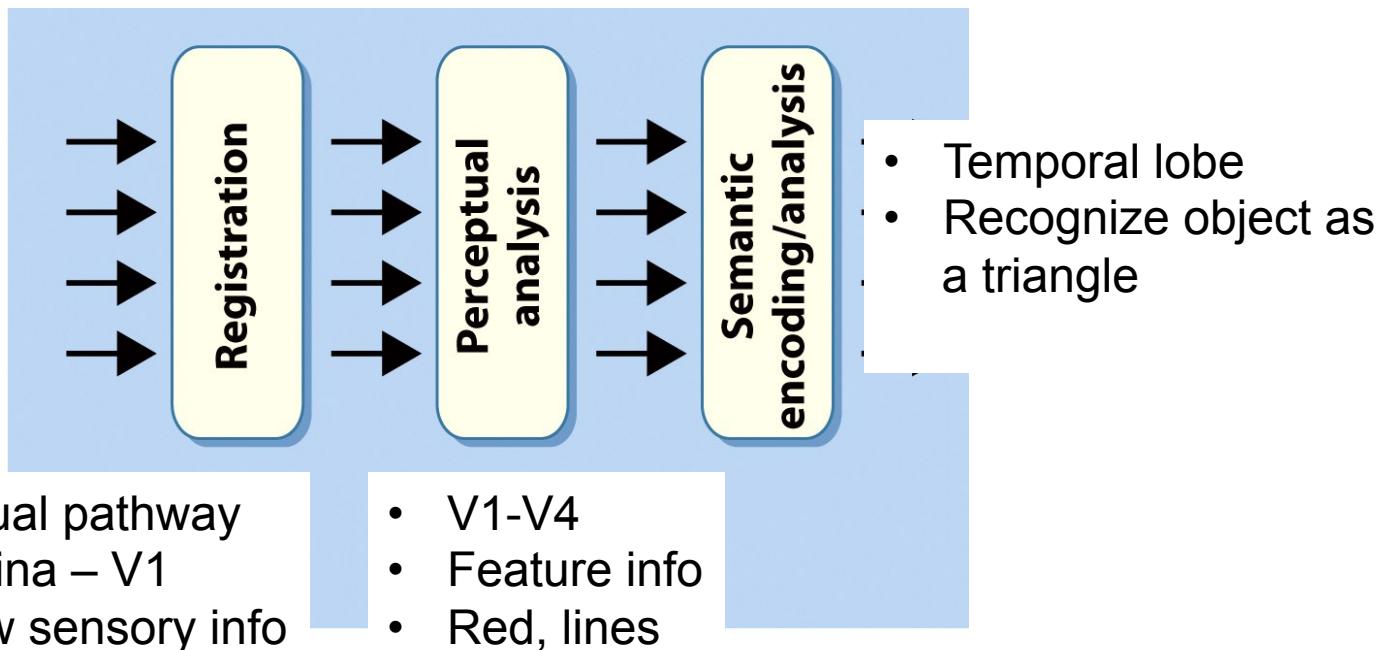
Volume control

Hear friend's voice, then choose to select or ignore it



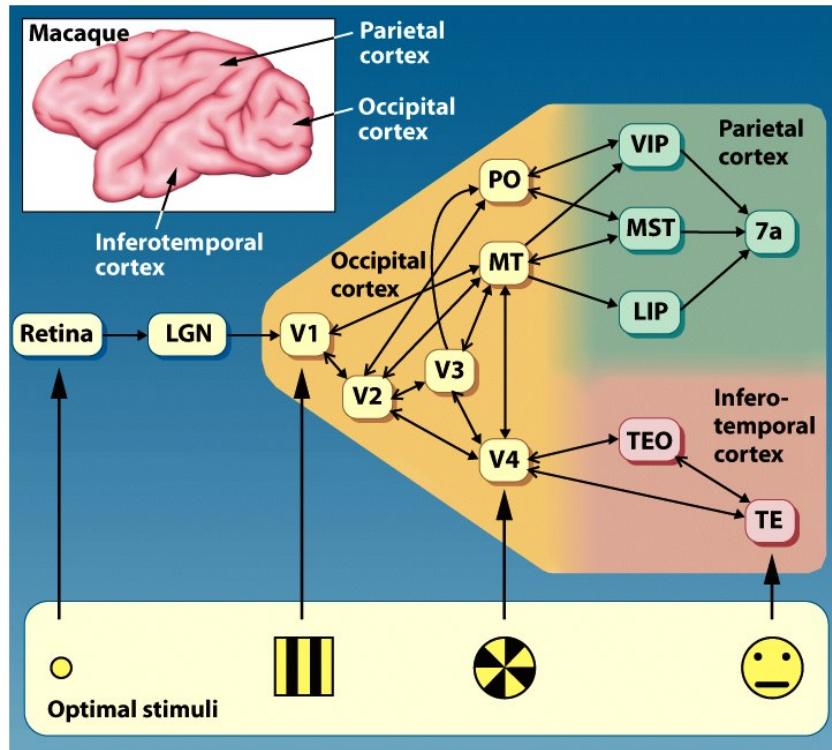
Think, pair, share

- Design an experiment to test *early* attention selection.



Is attentional selection early or late? (or where is the bottleneck in processing)?

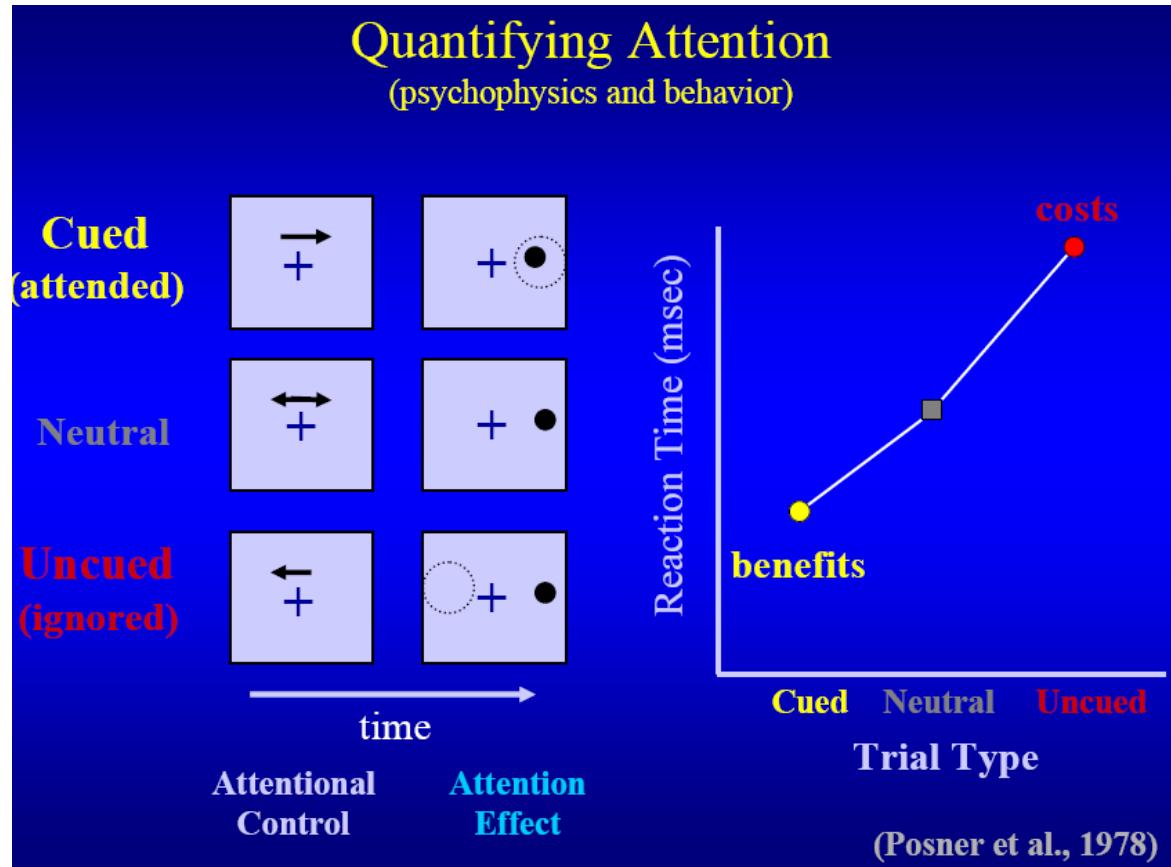
- Early or late in time **ERPs**
- Early or late in processing hierarchy **fMRI**



What methods to use?

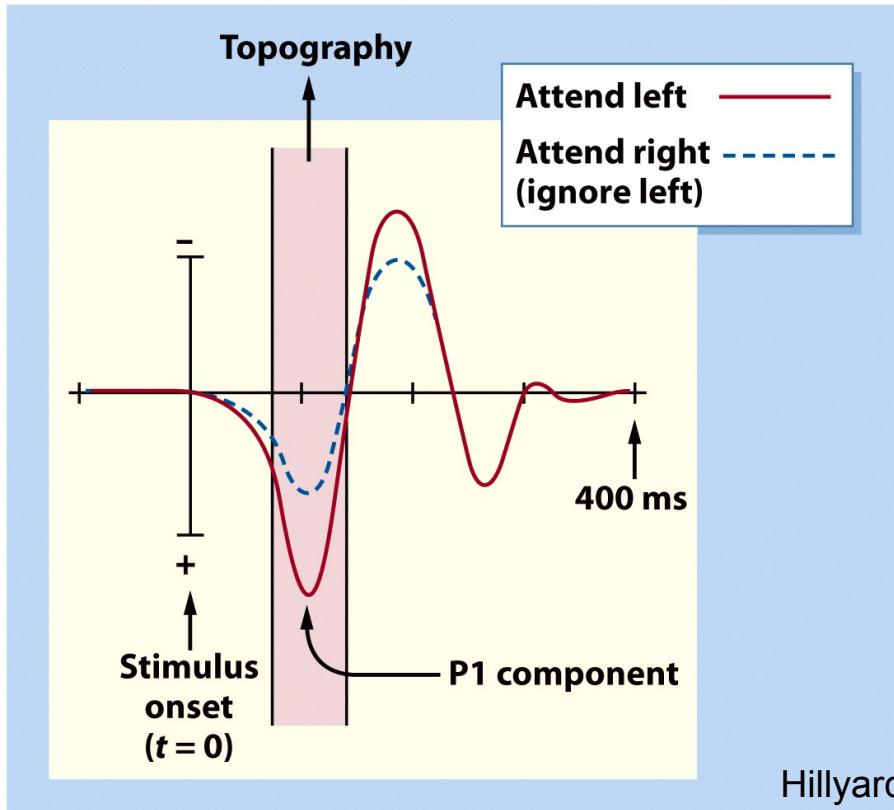
Voluntary visual spatial attention

Posner Spatial Cueing Task

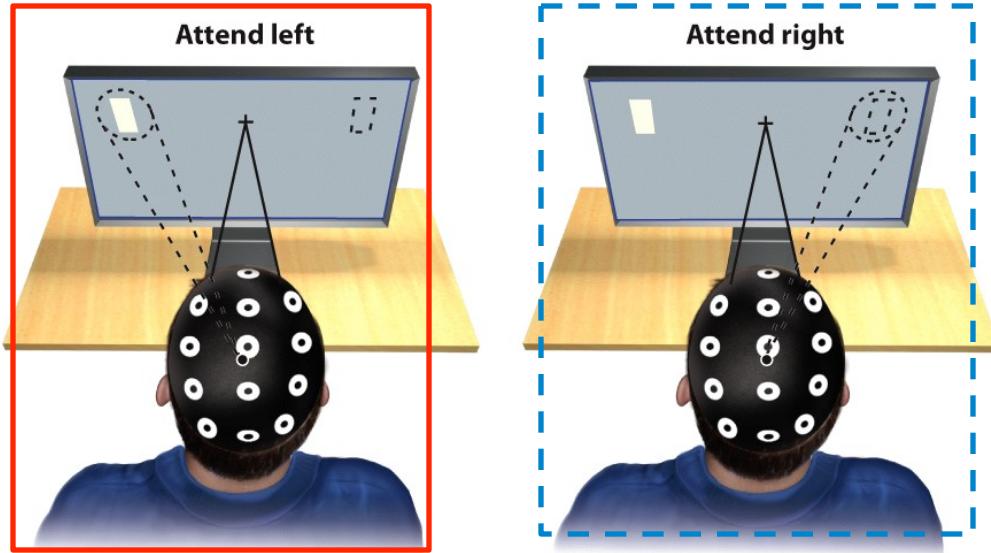


Compare same sensory stimulus under different conditions of attention

Early Selection & ERP



Electrode over right occipital cortex



Hillyard et al.

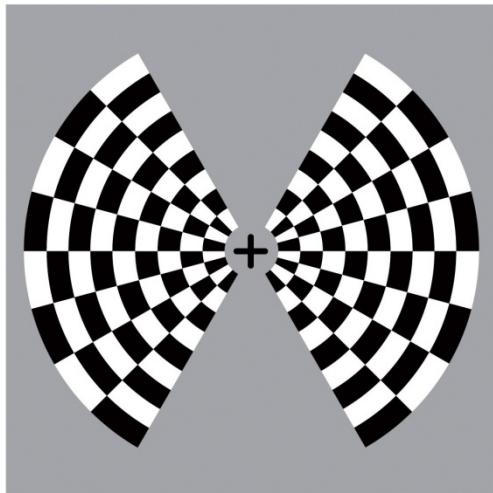
- P1 begins 70-90 ms after stimulus.
- Suggests attention amplifies perceived stimulus
- Similar findings in auditory attention (N1)

Is attentional selection early or late?

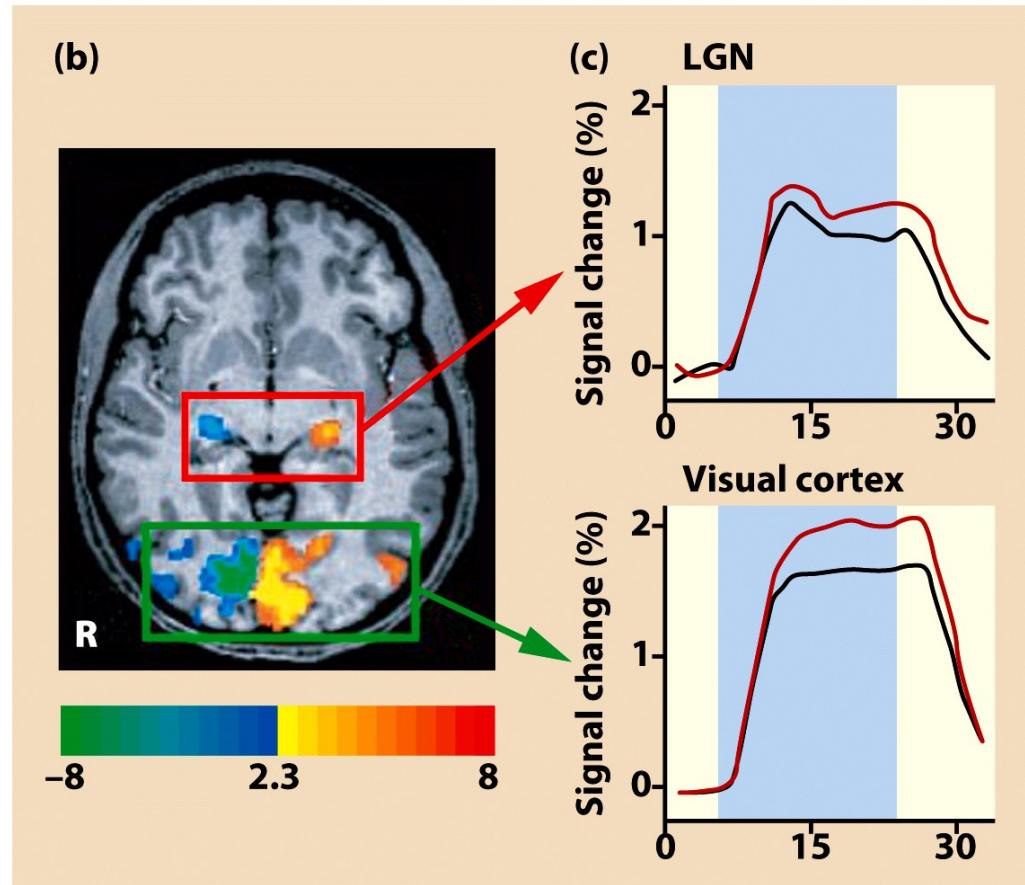
- When does voluntary attention begin to affect information processing?
 - Early.
 - Differences in auditory N1 and visual P1 due to attention begin well before 100 ms.
- Suggests incoming information is modulated as it arrives into sensory system.
 - As if a spotlight were highlighting information.



LGN modulated by spatial attention.

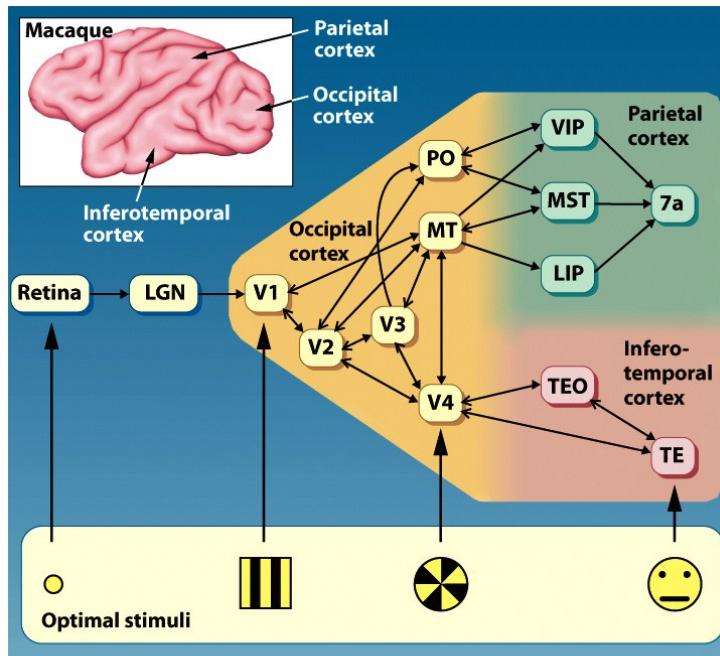


Attend to left or right
and detect
luminance change.



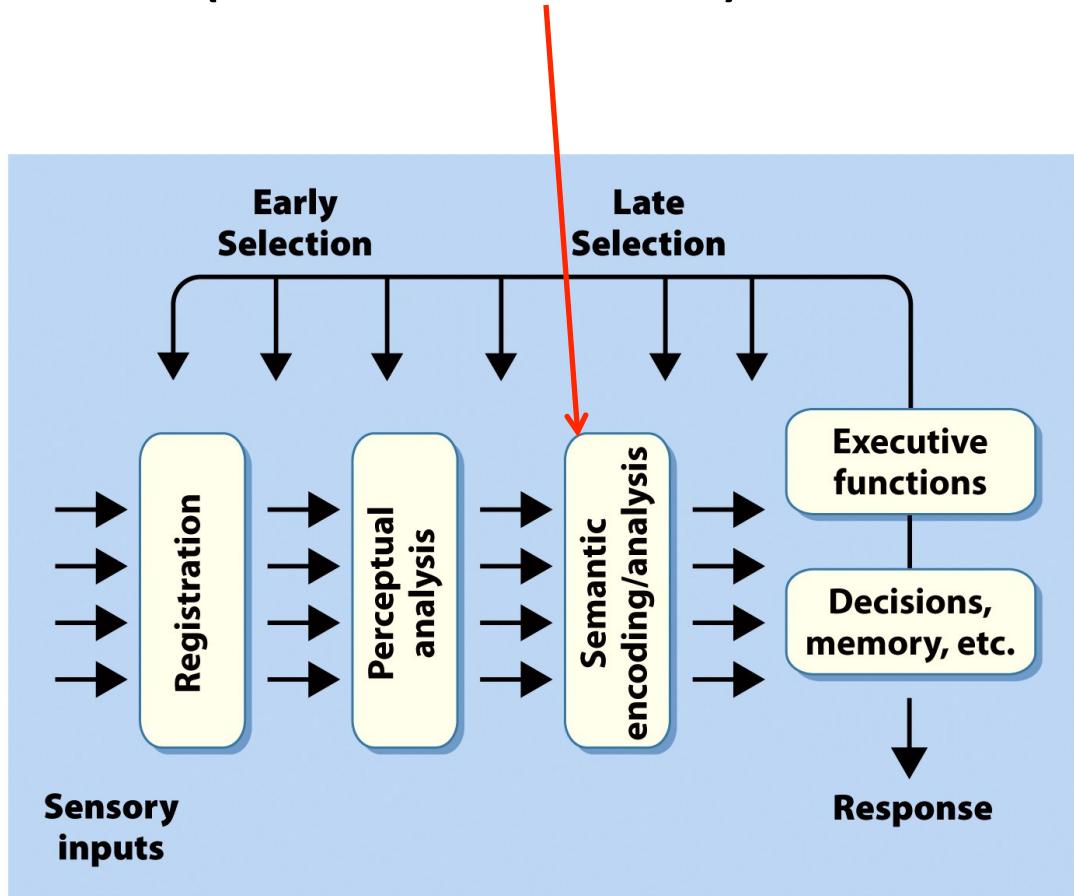
Where in the brain does voluntary attention have an effect on processing?

- Attention can modulate processing very early on in LGN and V1



Late selection

- Stroop effect (color of words)



Clap if you see the color red

- Not the word ‘Red’ but the actual color

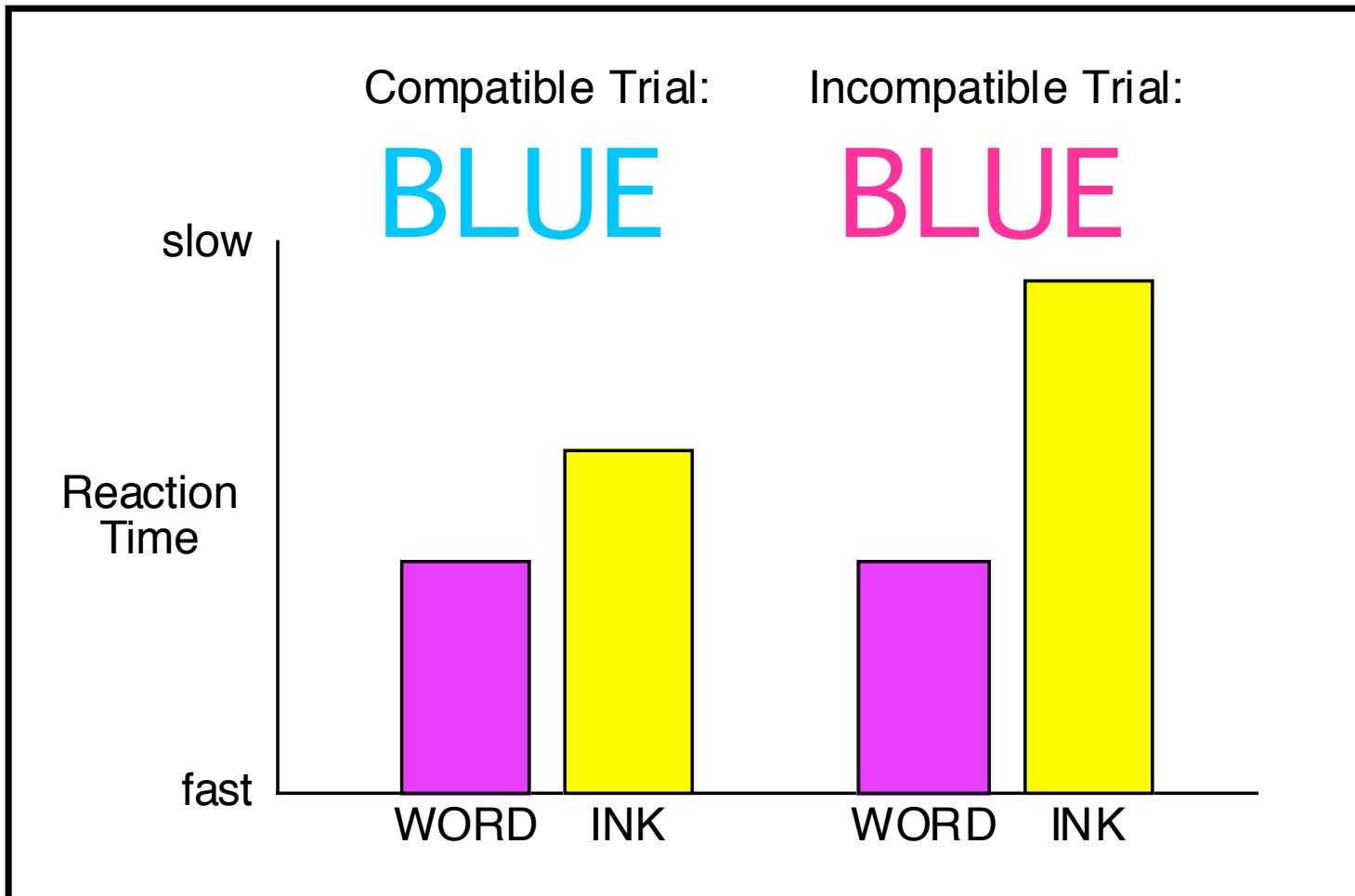
Blue

Red

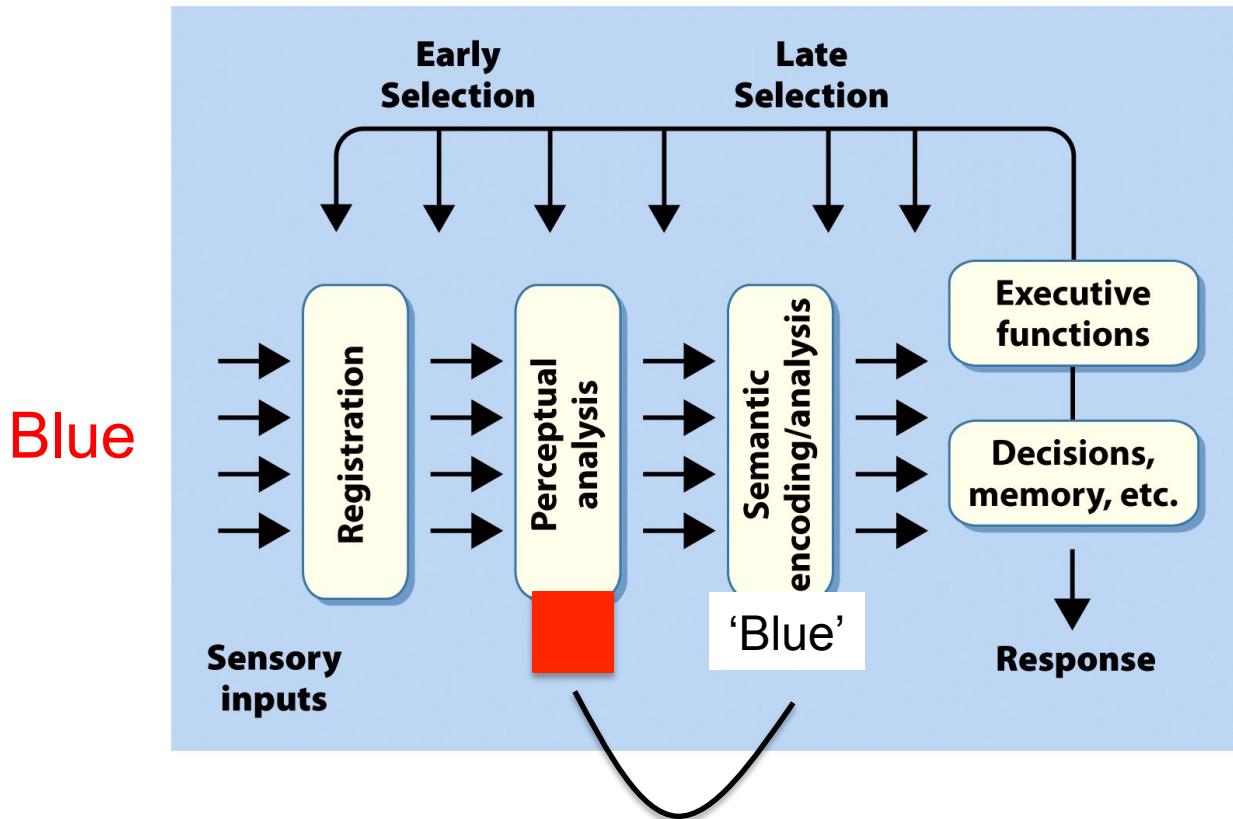
Blue

Red

Stroop Paradigm



Why is this late selection?



- Interference between semantic word and low level feature
- Suggests attention is still active after semantic analysis

Late selection



GREEN

Unattended information (words)

- 1) Still gets processed to semantic level
- 2) Interferes with processing of attended information (color)

Summary

- Attention selectively biases task-relevant information
- Attentional selection can be early on sensory inputs
- Can also be late so that the to-be-ignored distractors compete for responses

Common between early-selection and late-selection?

Not everything can be fully processed. Sacrifices (selected processing of some but not others) needs to be made